**Waves on a spring exploration lab** March 30th, 2017

**Some general details, tips and tricks for success:**

1. **DO NOT PLACE EXCESS TENSION ON THE SPRINGS. THIS WILL RUIN THE SPRINGS AND YOUR GROUP WILL NOT BE ABLE TO COMPLETE THE LAB.**
2. Make a group of 3 people and get one thin spring and a meter stick for your group.
3. Remember to rotate jobs within your group so everyone has a chance to handle the spring and observe the results.
4. Work through the observation sections making sure to note what you see, and why or why not your results do or do not agree with what you expect or think you know.
5. If at any time pulses are moving too quickly to tell what is going on add some slack to your spring to slow things down.
6. If you are finding it difficult to make observations, try changing the plane within which you are stimulating the waves. Will this change the results?
7. Please answer observations and data section with complete sentences.
8. **I AM NOT LOOKING FOR TEXTBOOK/GOOGLE ANSWERS; I am looking for completion, thought, and inquiry. Be a scientist and have some fun!**

**Observations and Data:**

Have the people on each end of the spring spread out such that the spring is not excessively sagging.

1. Create a single pulse from one side. What happens to the amplitude of the pulse as it passes from end to end? Theorize why this is happening?
2. Use a meter stick to measure the approximate length of your spring stretched out between your partners. Measure the time it takes a small pulse to go end to end. Repeat the same for a pulse with large Amplitude. Calculate the wave velocity for both the large and small Amplitude pulse. Does the speed of a pulse depend on the amplitude of the pulse?
3. Increase the tension in the spring slightly from how is was for question 2) by having the people on the end of the spring move further apart. Use a meter stick to measure the approximate length of your spring stretched out between your partners. Measure the time it takes a pulse to go end to end. Calculate the wave velocity. Has the velocity changed from question 2? What can you conclude from your observations about the effects of the tension in the spring?
4. Return to regular tension in the spring. When your pulse reaches the end of the spring is the reflected pulse inverted or upright? What if you make a wave of one complete wavelength? Draw your results for the complete wavelength (include incident and reflected wave).
5. Rather than a single pulse produce a traveling wave of one complete wavelength. Does the wavelength (length) of your travelling wave change as it travels? Does your result agree with what you see for single wave pulses?
6. What can you do to increase the value of your wavelength? Decrease?
7. Create single pulses in the same orientation simultaneously from each side of the spring. Do the pulses bounce off each other or pass through each other? How do you know?
8. When you create single pulses in the same orientation simultaneously from each side of the spring what happens to the amplitude of the pulses when they come together? Draw what you see just before the waves come together and after they come together.
9. Now create single pulses in the opposite orientation simultaneously from each side of the spring. What happens to the amplitude of the pulses when they come together? Draw what you see just before the waves come together and after they come together.
10. Try creating a standing wave with 2 nodes and 1 antinode. Next try creating a standing wave with 3 nodes and 2 antinodes. Draw what each standing wave looks like. What did you have to change to create standing waves with more nodes and antinodes? **TIP:** The spring should only be stimulated from one side when creating a standing wave.
11. Until now we have been looking at transverse waves. Have one member in your group reach forwards as far as possible, grab onto the spring and bring their two hands together while keeping the spring straight. While holding on with your back hand release your front hand releasing the tension between your two hands (if you are unsure about what you are doing please ask). What type of wave have you created? The wave may be very hard to see; is their other evidence that there is a pulse travelling through the spring? What is this evidence?
12. Is it possible to create a surface wave with the spring? If so, how? If not, why?

Incident Wave

Reflected Wave

Transmitted Wave

Amplitude

Wave lab terminology:

= wavelength

f

**Follow up questions:**

1. We used transverse waves for most of this activity. If we would have used longitudinal waves would the results have been the same? In one sentence explain why or why not?
2. Soon in class we will discuss sound waves. Using what we learned today do you think the speed of a sound wave depends on its loudness? Do louder sound waves travel faster than slower sound waves? (Hint: Consider the property of a wave that correlates to the Energy (Loudness) of the wave?)
3. Name at least 3 reasons why the waves we created today eventually dissipate? Where is the energy from the waves we created today going? Is any energy being destroyed? Why or why not?
4. Assume the frequency for question 2) and 3) in the data and observations section was approximately 1.0 Hz. Calculate the approximate wavelength of your wave. Now do the same calculation assuming the frequency was approximately 10 Hz and 100 Hz. Comparing the answers you get for the wavelength, which frequency 1, 10, or 100 Hz seems most plausible for the approximate frequency for the wave you were generating?